Introducing debt

Argument in MM:

With equity financing firm issues & invests only if

\[ A + C \leq (A + R) \frac{E[A + R|issuance,C] - (I - C)}{E[A + R|issuance,C]} \]

\[ = (A + R) - [A + R] \frac{(I - C)}{E[A + R|issuance,C]} \]

\[ = (A + C + R - I^*) - [I - C] \frac{(A + R) - E[A + R|...]}{E[A + R|...]} \]

\[ = (A + C + R - I^*) - \text{loss or gain to (new) equity holders} \]

Note: \( E[\text{loss/gain}] = 0 \) in equilibrium \( \Rightarrow \) see formally above.
With debt financing

\[ A + C \leq (A + C + R - I^*) - \text{loss or gain to (new) debt holders} \]

Use option-pricing argument: \(|\Delta_E| > |\Delta_D|\), i.e. gain or loss for equity holders always larger than for debt-holders.

\(\rightarrow\) If firm pre-announces use of debt or equity: if both negative, the firm invests; if both positive or 0, then debt will be issued in some states of the world where equity will not be issued. Thus less underinvestment under debt. Thus ex-ante value of the firm higher under debt.

\(\rightarrow\) If firm announces use of debt or equity only at \(t = 1\): Issuing equity signals \(\Delta_E < 0\) (since \(|\Delta_E| > |\Delta_D|\) and firm choose equity if \(\Delta_E < \Delta_D\). Thus, issuing equity signals a sure loss. Thus the firm will never issue equity.
Formally

Suggestion: Consider an investment project with cost $I$ and a stochastic return $\tilde{R}$, given by $R_G$ with probability $p$ and $R_B$ with probability $1 - p$, where $R_G > R_B$.

Start with $A$ non-stochastic.

The firm can use cash $c \in [0, C]$, can issue debt with face value $w$, and offer new shares $s'$.

The firm can thus obtain sufficient financing for the investment project if

$$I \leq A + C + E[\tilde{R}].$$

(1)

First derive the CEO’s choice of financing conditional on implementing the project.
The CEO will implement the project only if the resulting value to old share-
holders is higher than \( A + C \), the value of the firm without implementing the 
investment project.

\[
\begin{align*}
\text{max} & \quad \frac{s'}{s + s'} E[(A + C + \tilde{R} - c - w)^+] \\
\text{s.t.} & \quad \frac{s}{s + s'} E[(A + C + \tilde{R} - c - w)^+] = I - c - d \\
& \quad E[\min\{w, A + C + \tilde{R} - c\}] = d \\
& \quad 0 \leq c \leq C, \quad d \geq 0, \quad c + d \leq I
\end{align*}
\]

Note that the right-hand side of (3), \( I - c - d \), is the financing gap remaining 
after the use of cash and debt and equals the market price of the new shares if 
the investment project is implemented.

\[\Rightarrow\] Next steps: Homework 1. (Due: Friday by 1:15pm in Evans 645, Judi 
Chan, or Evans 643, Ulrike Malmendier).